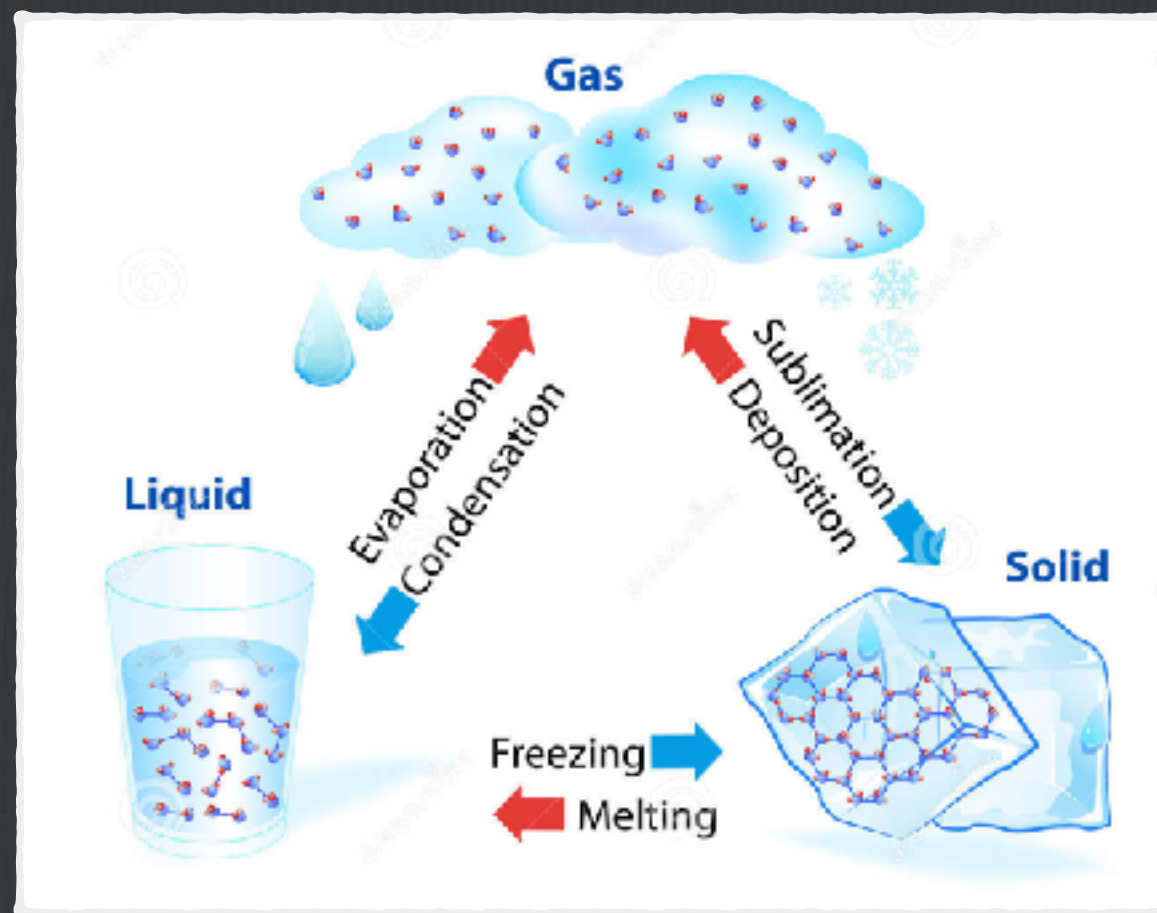




States of Matter

Introduction to Thermal Energy

Changes of State



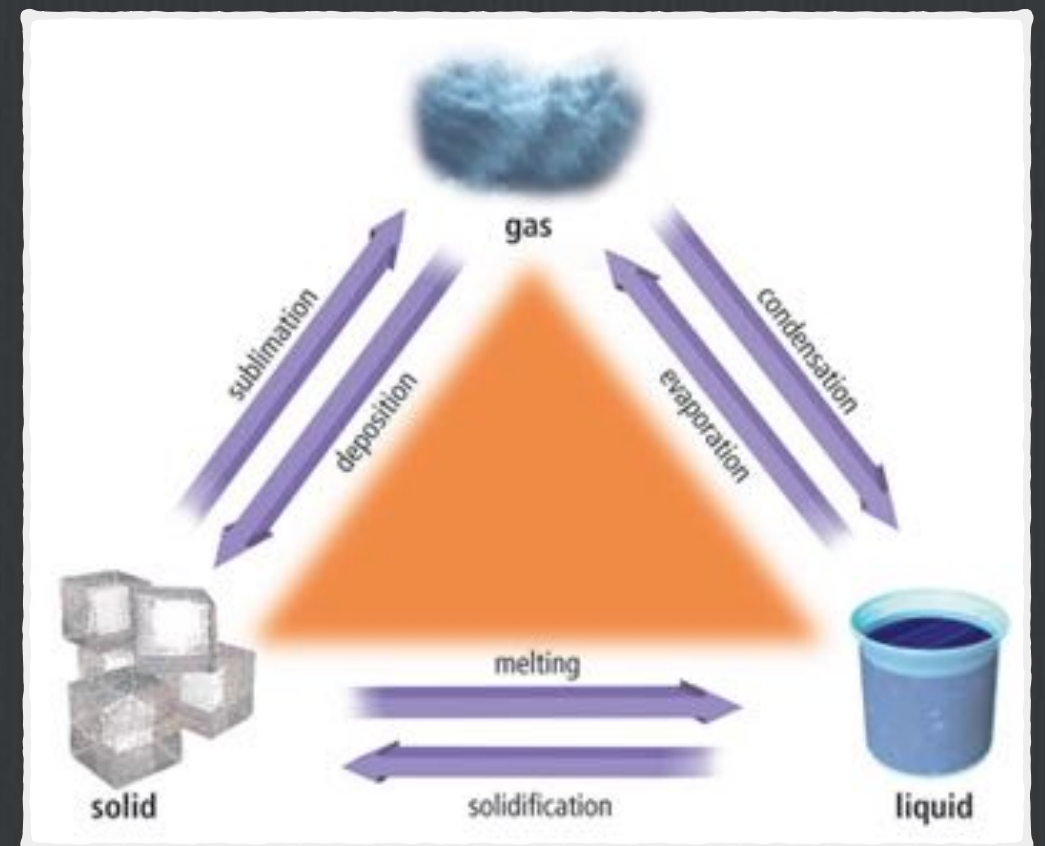
The physical change from one state of matter to another is called a **change of state**.

States of Matter

What happens when you hold an ice cube in your hand? It melts. The solid and the liquid are both the same material - water.

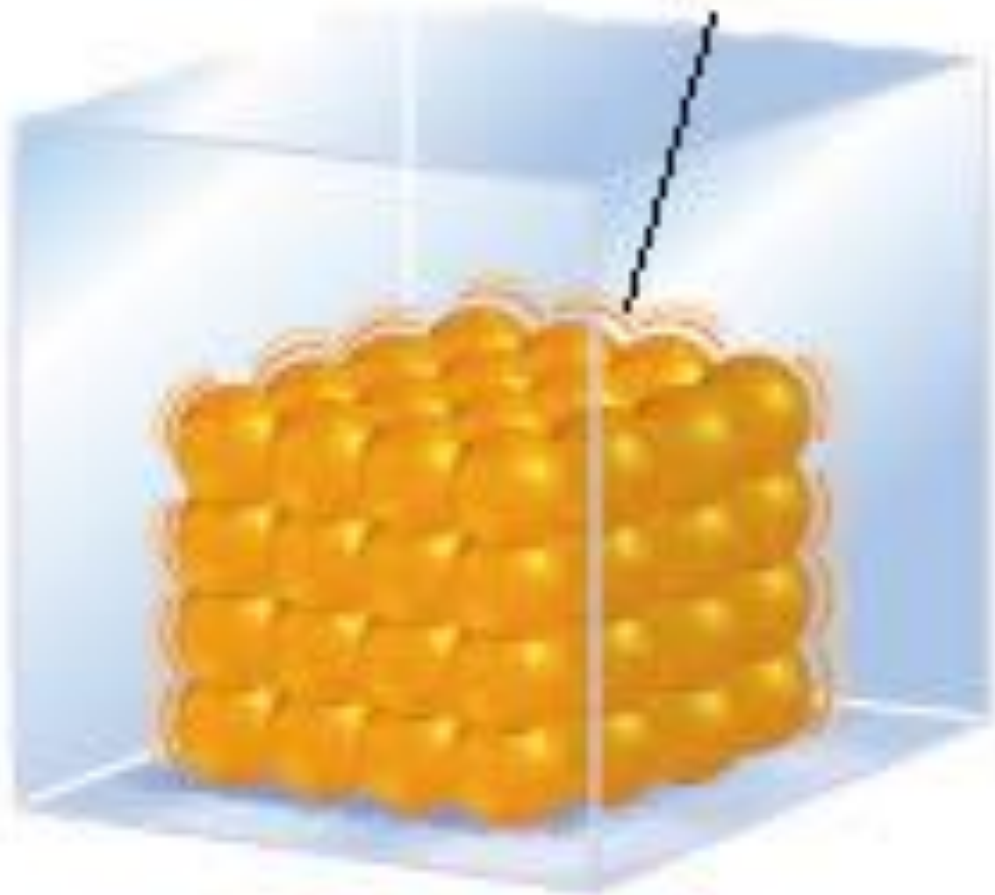
Water can exist in three different states, or forms. Most matter on Earth can exist in three states: Solid, liquid, & gas.

Although the chemical composition of matter remains the same, the arrangement of the particles that make up the matter differs from one state to another.



Solids

Particles "Vibrate"



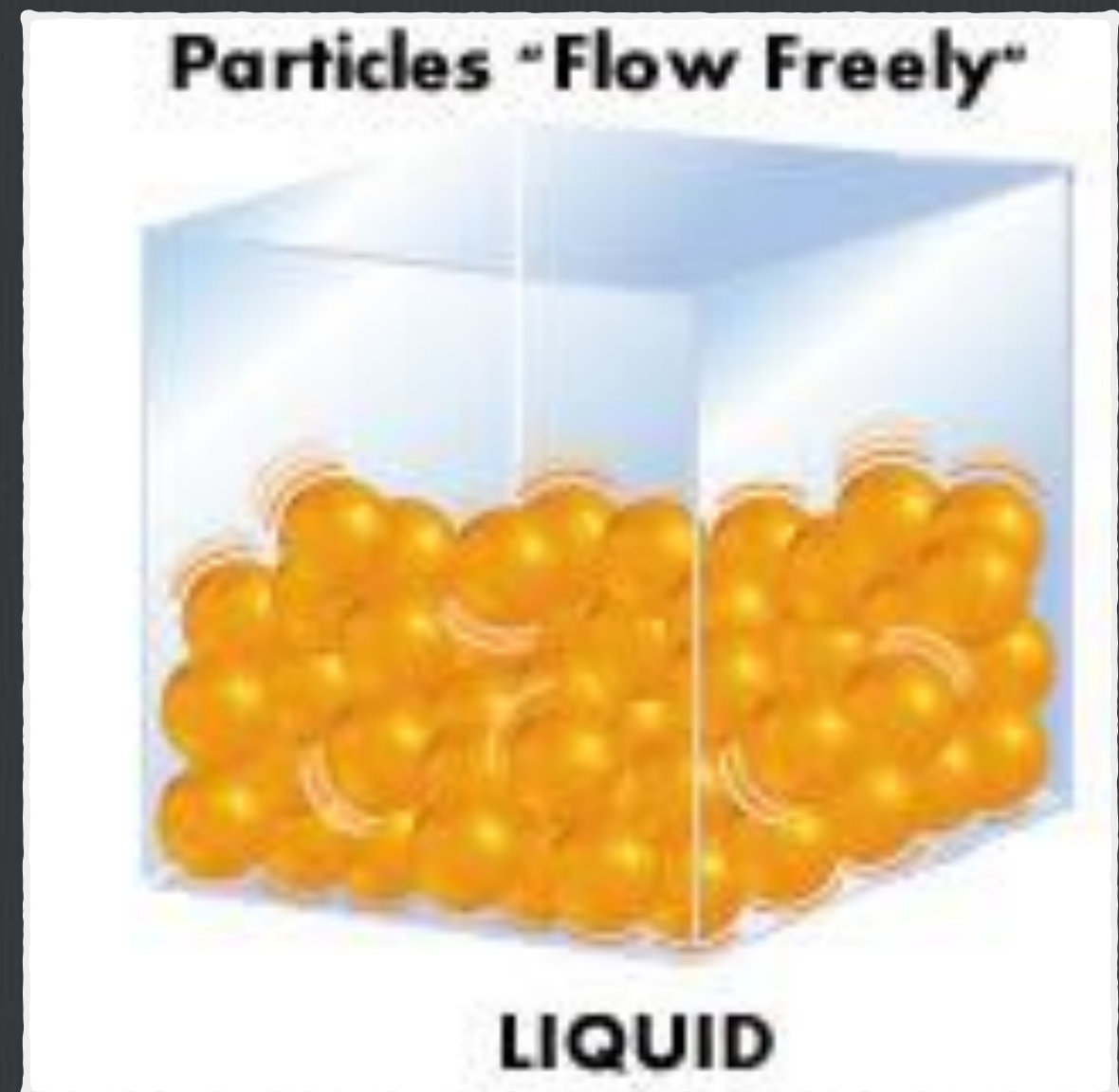
SOLID

The particles that make up **solids** are packed together in relatively fixed positions. Particles of a solid cannot move out of their positions. They can only vibrate back and forth. This is why solids retain a fixed shape and volume.

Because the shape and volume of a plastic block does not change, the plastic is solid.

Liquids

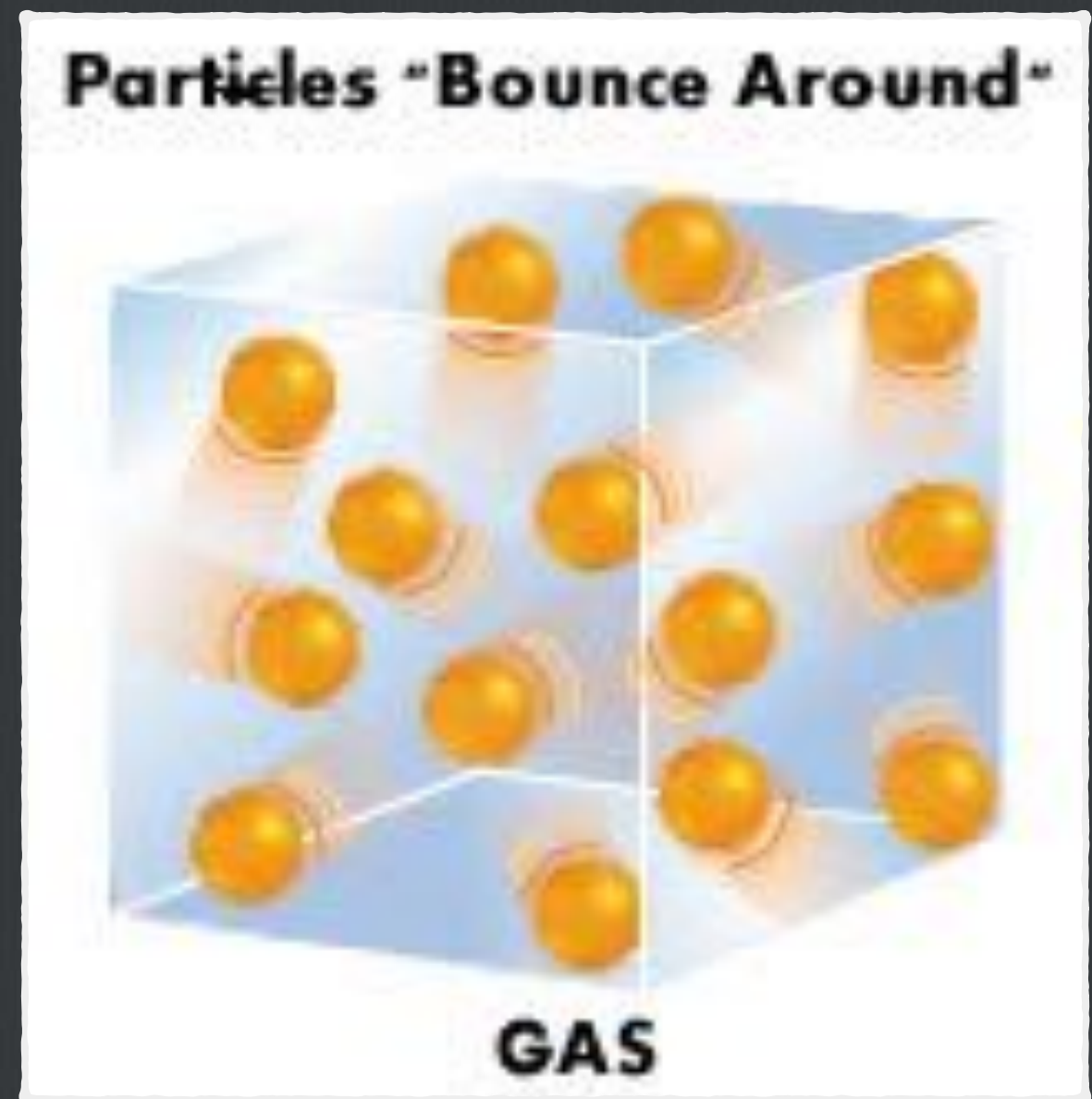
The particles that make up a liquid are close together, but they are not held together as tightly as those of a solid. Because **liquid** particles can move around, liquids don't have a definite shape. But liquids do have a definite volume.



Gas

Particles in gases are moving so fast that they don't even stay close together.

Gases expand to fill all of the space available. **Gases** don't have a definite shape or volume.



Thermal Energy

The atoms in an object are in constant motion.

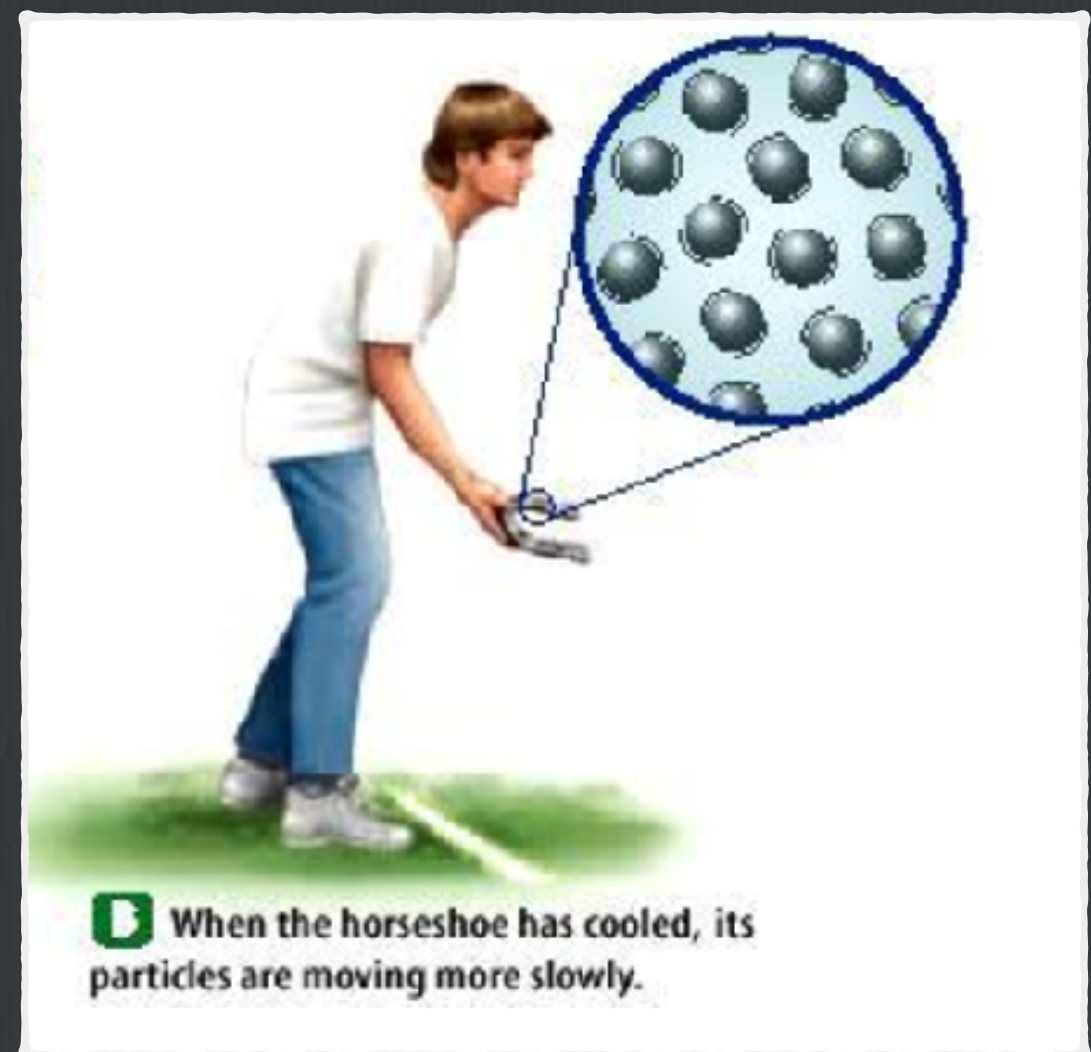


The state of matter depends on the amount of thermal energy it has. The more thermal energy matter has, the faster the particles move. Since gas has more thermal energy than a liquid, the particles of a gas move faster than the particles of the same matter in a liquid state.

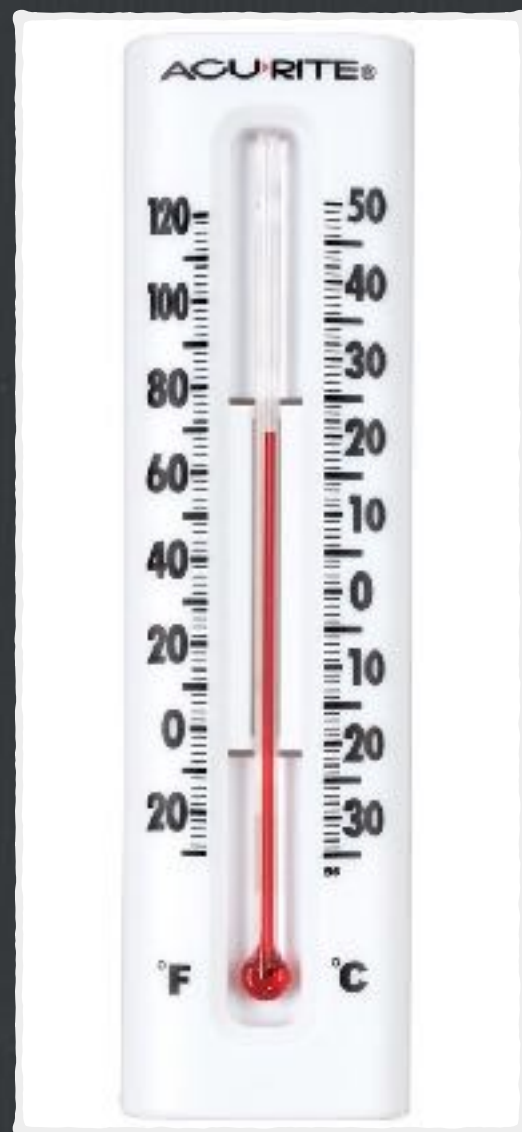
Matter and Thermal Energy

Matter can change from one state to another when thermal energy is absorbed or released. A gas changes to a liquid and then to a solid as thermal energy is removed from it.

During a change of state, the addition or loss of thermal energy changes the arrangement of the particles. However, the average kinetic energy of those particles does not change.



Temperature & Thermal Energy



Since temperature is a measure of average kinetic energy, temperature does not change as the state of matter changes. As the thermal energy of the solid increases, the structure of its particles breaks down. The particles become more free to move around.

As the thermal energy of matter increases, its particles spread out and the substance expands.

Melting & Freezing

The temperature at which a solid changes to a liquid is called the **melting point**.

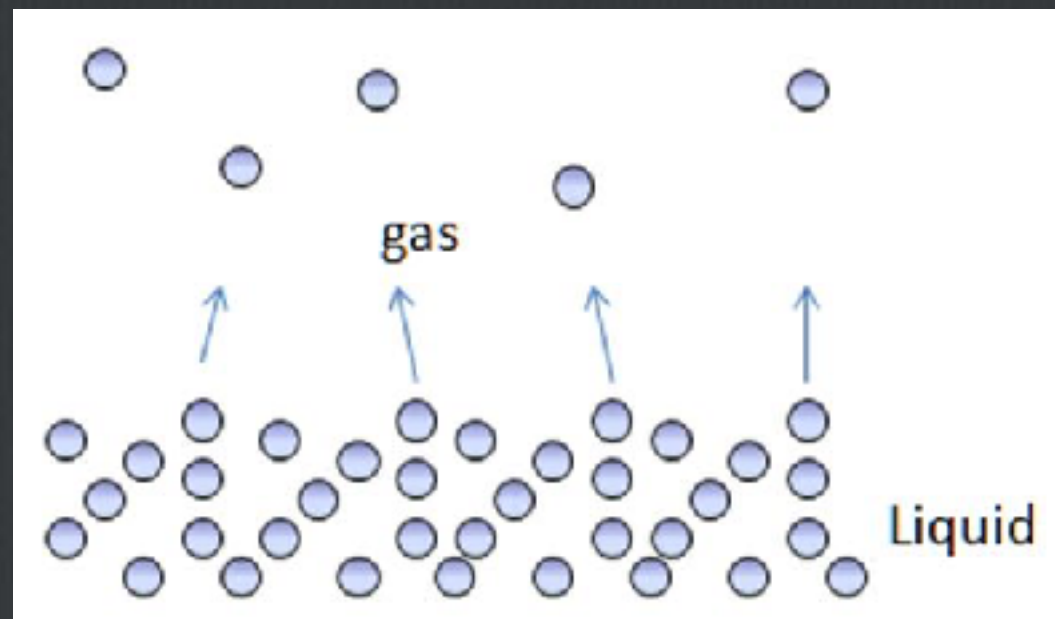
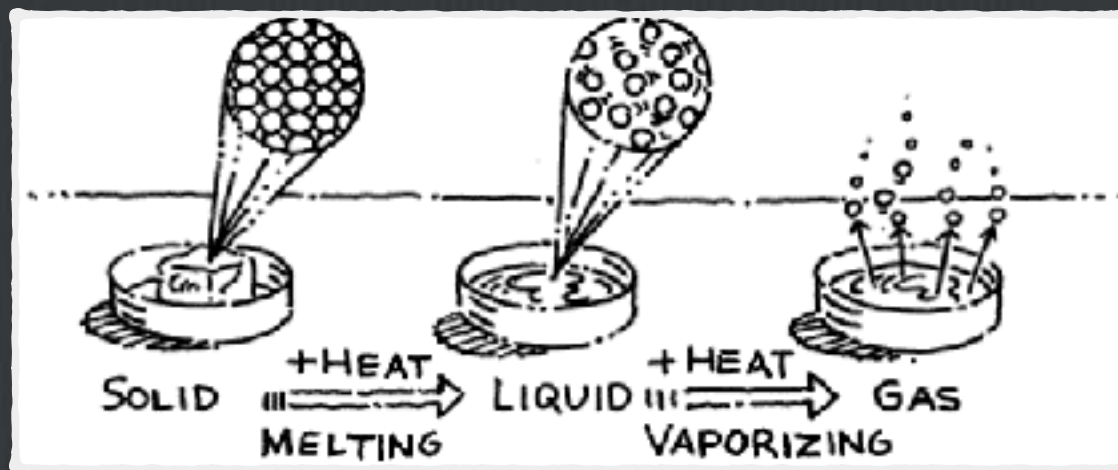
The change of state from a liquid to a solid is called freezing. Freezing occurs when matter releases thermal energy.

The temperature at which matter changes from a liquid to a solid is called its **freezing point**.



For a given type of matter, the freezing point and the melting point are the same. The difference between the two is whether the matter is gaining or releasing thermal energy.

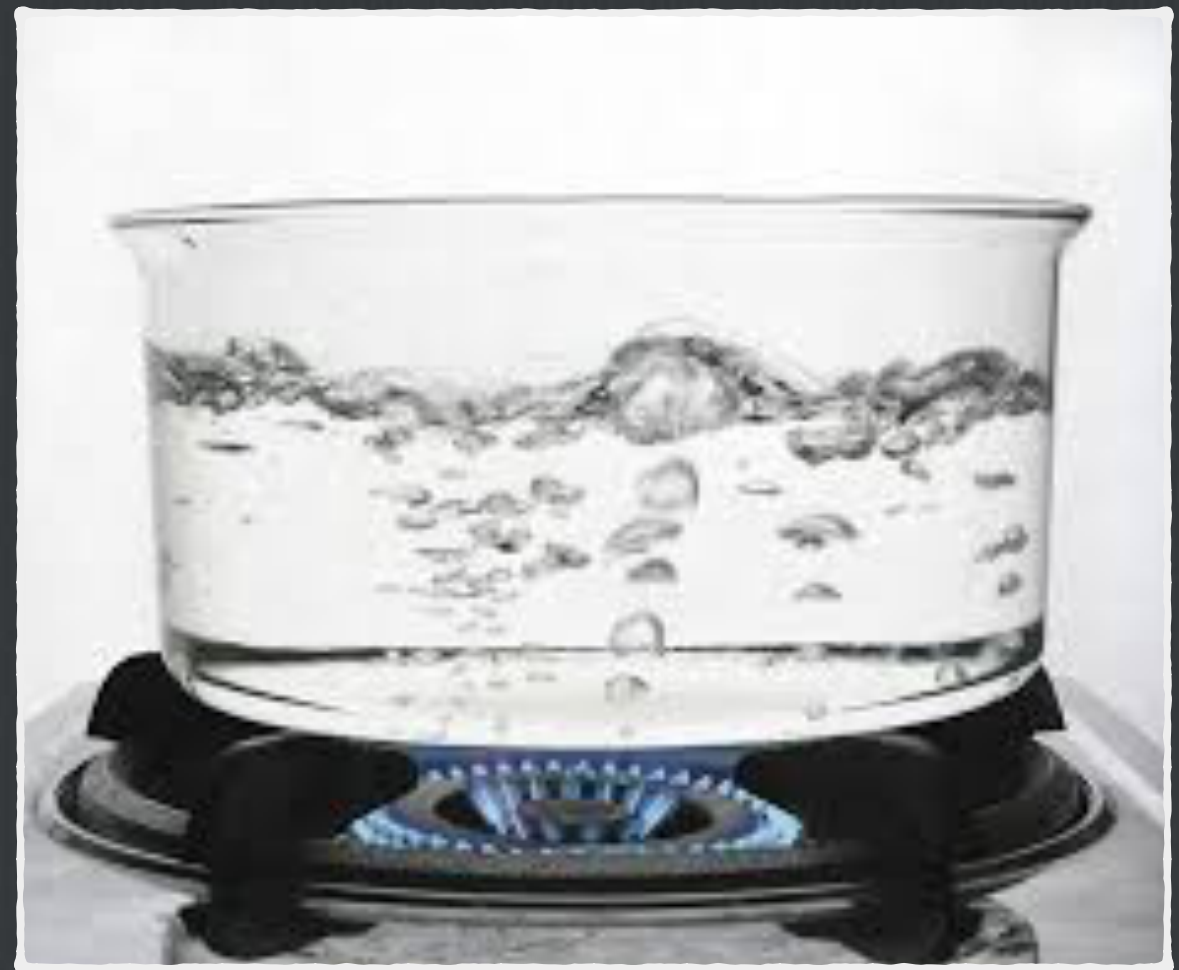
Evaporation



During this process, particles in a liquid state absorb thermal energy and move faster. Eventually the particles move fast enough to escape the liquid as gas particles. If vaporization takes place at the surface of a liquid, it is called **evaporation**.

Boiling

At higher temperatures, vaporization can occur below the surface of a liquid as well. This process is called boiling. When a liquid boils, gas bubbles that form within the liquid rise to the surface. The temperature at which a liquid boils is called its **boiling point**.



Changing States

Solid - Liquid Changes of State

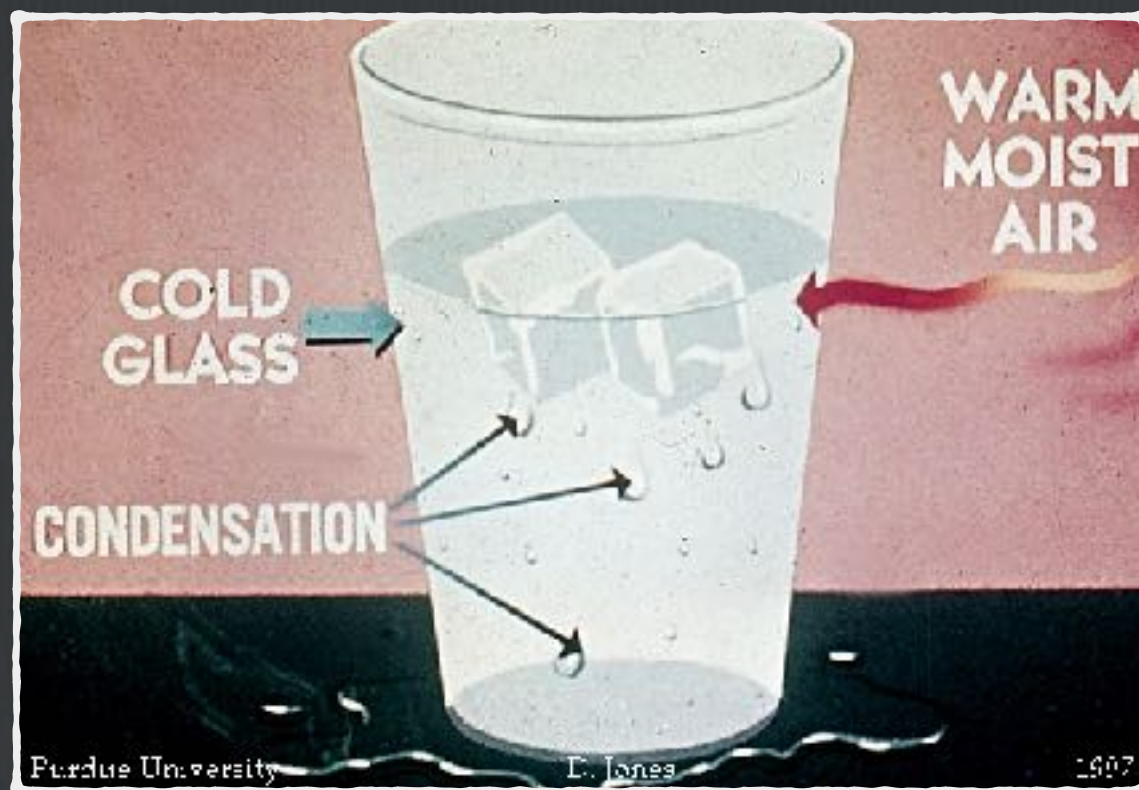
The change of state from a solid to a liquid is called **melting**. Melting occurs when a solid absorbs thermal energy.

Liquid - Gas Changes of State

Vaporization is when the liquid state changes to a gas. There are two types of vaporization: evaporation and boiling.

Condensation

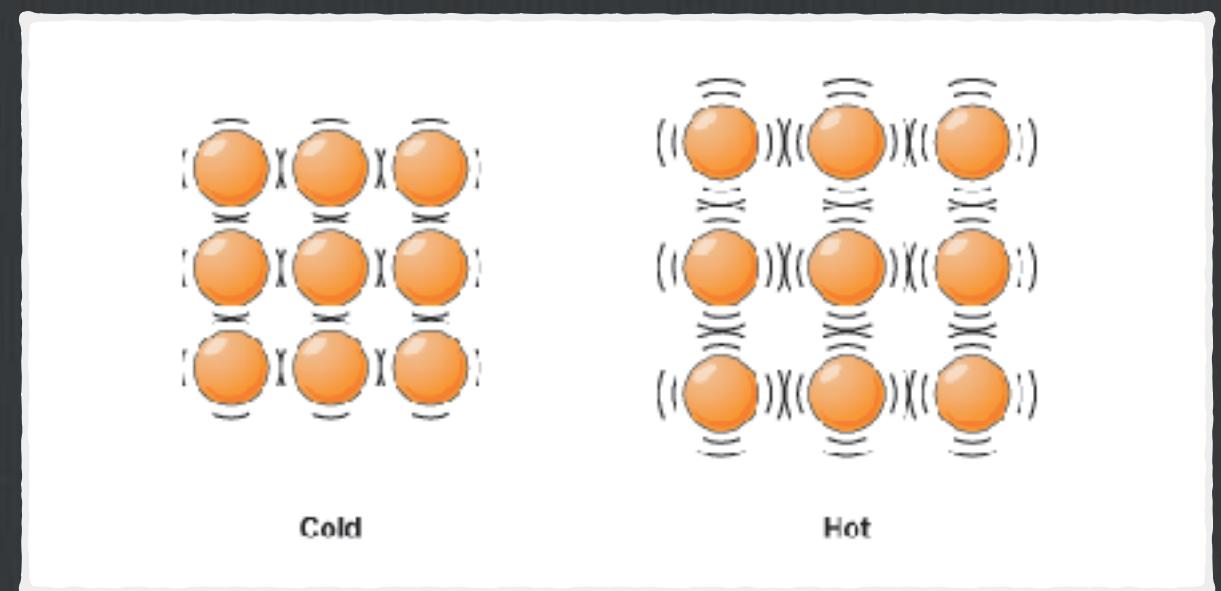
When a gas loses a certain amount of thermal energy, it will change into a liquid. A change from a gas to a liquid is called **condensation**.



Thermal Expansion

If you have seen beads of water appear on the outside of a cold drinking glass, then you have witnessed condensation. This occurs because water vapor in the air loses thermal energy when it comes into contact with the cold glass.

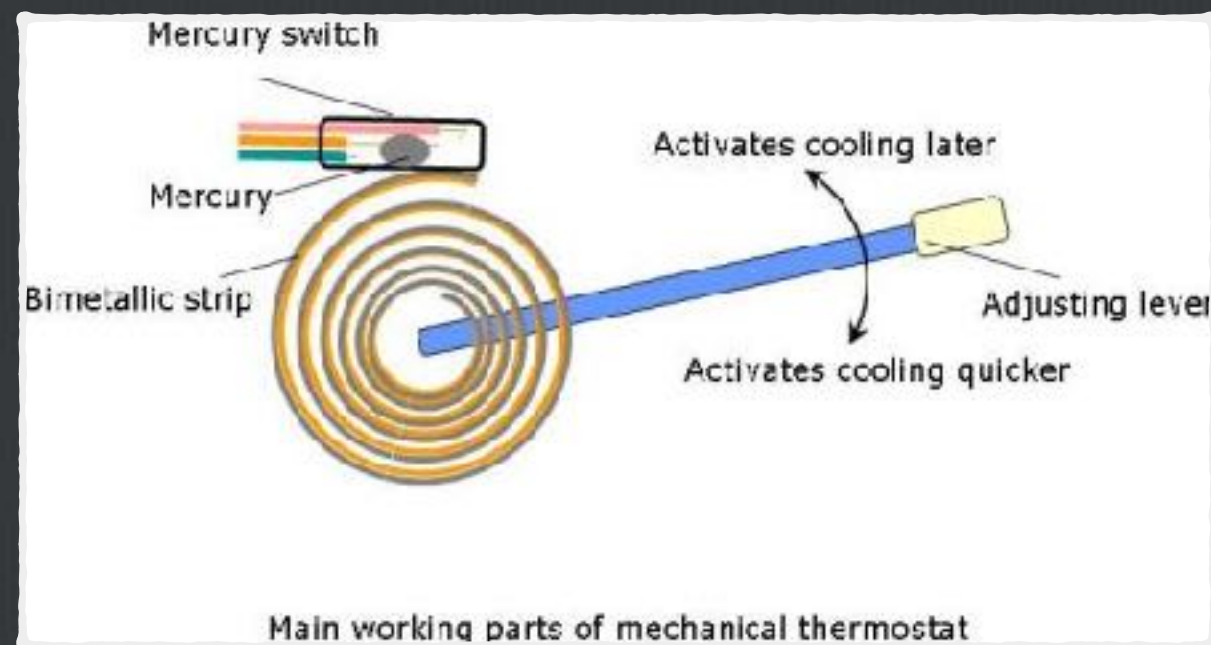
With few exceptions, this is true for all matter, even when the matter is not changing state. The expansion of matter when it is heated is known as **thermal expansion**.



When matter is cooled, thermal energy is released. The motion of the particles slows down and the particles move closer together. In nearly all cases, as matter is cooled, it contracts, or decreases in volume.

Thermostats

Heat - regulating devices called **thermostats** use thermal expansion to work. Many thermostats contain bimetallic strips, which are strips of two different metals joined together.



Different metals expand at different rates. When the bimetallic strip is heated, one side expands more than the other side. This causes the strip to uncurl. The movement of the strip operates a switch, which regulates heat in your home.

Keyword: English - Spanish

Solid - Sòlido

Evaporation - Evaporación

Liquid - Líquido

Vaporation - Vaporización

Gas - Gas

Condensation - Condensación

Melting Point - Punto de Fusion Thermostat - Termostato

Freezing Point - Punto de Congelación

Boiling Point - Punto de Ebullición

Thermal Expansion - Expansión Térmica